DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1, 4-12, and 16-19 have been considered but are moot in view of the new ground(s) of rejection.

The applicants have amended independent claims 1, 12, and 19 to incorporate additional limitations which further define the recited semiconductive substrate, gas-sensitive semiconductor film, and electric field, not previously presented, for consideration upon merits for patentability.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1, 4-12, and 16-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent claims 1 and 12 disclose an electric field that controls the electroadsorptive effect of the gas-sensitive semiconductor film. It is unclear, from the presented claim language, whether the electric field is applied by the field electrode and/or the semiconductive substrate. Appropriate amendments are required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1, 9, 12, 16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Torsi et al. (Multi-parameter gas sensors based on organic thin-film-transistors).

Regarding claims 1, 12, 16, and 19, Torsi discloses an organic thin-film transistor based gas sensor **(Fig. 1)** comprising: a silicon wafer substrate **(Conducting Substrate)**; an organic semiconductor gas sensitive film **(NTCDA)**; in contact with gold source **(S)** and drain **(D)** electrodes; a plurality of insulator layers **(Gate Dielectric: 200 nm Si_3N_4 and 100 nm SiO_2)** disposed next to the gas sensitive film; and a gold gate electrode **(G)** disposed between the insulator layers and the substrate (electrically in contact with the substrate), the gate electrode and silicon substrate functioning as a gate which provides a controlling surface potential **(pp312, see: 2. Experimental)**. While Torsi does not explicitly disclose any specific thickness of the insulator layer, the change in the thickness of the insulator layer is not considered to confer patentability to the claims. As the electric field produced by the field electrode(s), and therefore the sensitivity, is a variable that can be modified, by adjusting said thickness of the insulator layer, with said sensitivity increasing as the thickness of the insulator layer is decreased, the precise thickness would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed thickness of the insulator layer cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the thickness of the insulator layer in the apparatus of Gardener et al. to obtain the desired sensitivity controllability (In re Boesch, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art,

discovering the optimum or workable ranges involves only routine skill in the art. (In re Aller, 105 USPQ 223).

Regarding claim 9, modified Torsi discloses all of the claim limitations as set forth above. Torsi further discloses the thickness of the NTCDA organic semiconductor gas sensitive film to be about 50 nm thick **(Fig. 1; NTCDA's Debye Length is approximately 10 nm)**.

8. Claims 4-8, 10, 11, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Torsi et al. (Multi-parameter gas sensors based on organic thin-film-transistors), as applied to claims 1 and 12 above, in view of Scheinert et al. (Electrically controlled metal oxide gas sensor designed with PROSA-CHEM).

Regarding claims 4, 5, and 17, modified Torsi discloses all of the claim limitations as set forth above. While modified Torsi does not explicitly disclose a plurality of individually drivable microstructured field electrodes, Scheinert teaches a metal oxide gas sensor **(Fig. 8)** comprising with three individually drivable buried gates **(see: buried gates, each with an individual lead)**. It would have been obvious to one having ordinary skill in the art at the time of the invention to substitute the single gate electrode of Jacobson with a group of individually drivable gate electrodes, as taught by Scheinert, since doing so provides for increased control of the selectivity and sensitivity of the gas sensor **(Scheinert: pg 359-360 Conclusion)**.

Regarding claims 6-8 and 18, modified Torsi discloses all of the claim limitations as set forth above. While modified Torsi does not explicitly disclose an integrated

heater electrode or an integrated temperature control driver electronics, Scheinert teaches a metal oxide gas sensor chip **(Fig. 10)** comprising an integrated heater and a temperature sensor **(pg 358, see: Chip Layout)**. It would have been obvious to one having ordinary skill in the art at the time of the invention to integrate a heater and temperature control means into the thin film transistor device of Jacobson, as taught by Scheinert, since the dependency on temperature of FET based sensors is notoriously well known **(Scheinert: Figure 6)**, therefore the addition of a temperature control means would provide improved control and measurement consistency.

Regarding claim 10, modified Torsi discloses all of the claim limitations as set forth above. Scheinert further discloses the spacing between the buried gates is on the order of the grain size of the gas sensitive semiconductor film **(see: p359/C1/L4 discloses the SnO2 layer is about 55 nm thick; p358/C1/L3 discloses the grain size to be 50 nm; note the similar size between the thickness of the SnO2 layer and the space between the burred gates in Figure 8)**.

Regarding claim 11, modified Torsi discloses all of the claim limitations as set forth above. While modified Torsi does not explicitly disclose the gas sensitive semiconductor film comprising SnO2, Scheinert teaches a metal oxide gas sensor chip comprising a SnO2 gas sensitive layer **(Figure 10, see: SnO2)**. It would have been obvious to one having ordinary skill in the art at the time the invention as made to substitute one gas sensitive semiconductor film (NTACDA) for another (SnO2), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design

choice. In re Leshin, 125 USPQ 416. In this particular instance, the use of SnO2 in CHEMFET devices is notorious, and one having ordinary skill in the art would have recognized the appropriateness of tin oxide as a gas sensitive film for solid state sensors.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Mizsei (How can sensitive and selective semiconductor gas sensors be made) discloses various design choices for optimizing the performance of semiconductor gas sensors and Crone et al. (Electronics sensing of vapors with organic transistors) discloses an organic semiconductor field effect sensor.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT EOM whose telephone number is (571)270-7075. The examiner can normally be reached on Mon.-Thur., 9:00am-5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill Warden can be reached on (571)272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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